The rejections state (on page 2, second paragraph, among other locations) that the $Si_{1-x}Ge_x/SiO_2$ region of Selvakumar "forms a continuous $Si_{1-x}Ge_x/SiO_2$ gate oxide interface wherein no germanium oxide is present at the $Si_{1-x}Ge_x/SiO_2$ gate oxide interface. Applicant respectfully traverses the assertion that Selvakumar or Nakagawa show a device that includes both a continuous $Si_{1-x}Ge_x/SiO_2$ gate oxide interface; and a gate oxide interface where no germanium oxide is present at the $Si_{1-x}Ge_x/SiO_2$ gate oxide interface. Applicant respectfully submits the following arguments:

1. The processes used by the Selvakumar reference and in the Nakagawa reference implant germanium (Ge) atoms in the channel region before oxidizing to form a gate oxide.

The process of forming the gate oxide in Selvakumar is described in Col. 3, lines 40-68, and in Col. 4, lines 1-3. The description in Selvakumar appears to include first implanting germanium through an exposed window (Col. 3, lines 41-44), then forming a dry gate oxide (Col 3, lines 45-48). Forming the dry oxide is further described as being performed at 1100° C for 50 minutes in dry oxygen and a 20 minute nitrogen anneal.

The process of forming the gate oxide in Nakagawa is described in Col. 5, lines 23-28. The gate oxide 18 of Nakagawa appears to be formed subsequent to the implantation step by a thermal oxidation process. The Examiner appears to agree that the process of Selvakumar and Nakagawa both form the gate oxide subsequent to the Ge implantation step.

2. Applicant submits that, depending on the process conditions of the ion implantation, the ion implantation process either leaves the Ge atoms exposed at the surface to be oxidized, or it buries the Ge atoms in the substrate beneath the surface to be oxidized.

The Selvakumar reference appears silent as to depth of implanted Ge atoms. Applicant submits that in either case, the product resulting from the described process as taught by Selvakumar does not produce a $Si_{1-x}Ge_x$ region with both: a continuous $Si_{1-x}Ge_x/SiO_2$ gate oxide interface; and no germanium oxide present at the $Si_{1-x}Ge_x/SiO_2$ interface.

Nakagawa appears to describe an embodiment in Figure 1 where the SiGe region is buried beneath an intermediate silicon layer, and an embodiment in Figure 3 where the SiGe

region includes exposed Ge atoms prior to oxidation to form the gate oxide.

3. If the implanted Ge atoms are buried, then by definition, an intermediate silicon layer exists between the channel surface to be oxidized and the implanted Ge atoms. A continuous $Si_{1-x}Ge_x/SiO_2$ gate oxide interface does not exist due to the intermediate layer of silicon.

4. If the implanted Ge atoms are exposed on the surface to be oxidized, Applicant submits that one skilled in the art will recognize that using the subsequent oxidation process of Selvakumar or Nakagawa as described above, germanium oxide will necessarily be created at the $Si_{1-x}Ge_x/SiO_2$ gate oxide interface. Germanium oxides are undesirable because they are not stable, as discussed on page 2, lines 16-19 of Applicant's specification. Neither the Selvakumar reference, nor the Nakagawa reference appear to recognize or address the negative aspects of germanium oxides.

5. In contrast, devices as claimed by Applicant, and products produced by the process claimed by Applicant include a continuous $Si_{1-x}Ge_x/SiO_2$ gate oxide interface wherein no germanium oxide is present at the $Si_{1-x}Ge_x/SiO_2$ gate oxide interface. Applicant's unique process implants the germanium after the gate oxide has been formed. The implant of germanium atoms in Applicant's process is directed through the gate oxide, and forms a $Si_{1-x}Ge_x$ channel region and a continuous $Si_{1-x}Ge_x/SiO_2$ gate oxide interface. No oxidation steps are performed in Applicant's process subsequent to the germanium being introduced to the channel region.

The process of Applicant's invention therefore leads to a unique structure implied by the process recited in the claims. No germanium oxide will be formed at the $Si_{1-x}Ge_x/SiO_2$ gate oxide interface formed in Applicant's invention because the germanium in Applicant's process is never exposed to an oxidation step. As noted above, germanium oxides are undesirable because they are not stable, as discussed on page 2, lines 16-19 of Applicant's specification.

The Examiner asserts on page 16 of the pending Office Action that Selvakumar "does <u>not</u>

"inherently" produce germanium oxide along with silicon dioxide when forming the gate oxide layer." As support for this position, the Examiner cites col. 4, lines 18-19 where Selvakumar et al disclose ". . . interface between [the] silicon-dioxide [gate oxide layer] and the SiGe channel region." The Examiner also cites col. 5, lines 10-11 where Selvakumar reads "the extremely abrupt interface at SiGe-channel/Silicon dioxide."

Applicant respectfully traverses these citations as support for a continuous $Si_{1-x}Ge_x/SiO_2$ gate oxide interface wherein no germanium oxide is present at the $Si_{1-x}Ge_x/SiO_2$ gate oxide interface. Applicant respectfully submits that in light of the gate oxidation process used in Selvakumar the references to a "SiGe channel region" and a "SiGe-channel" must be interpreted to either include an intermediate silicon layer or they include germanium oxide. Because the reference does not appear to recognize the negative aspects of germanium oxides, there would be no reason for Selvakumar to refer to the interface at the SiGe channel region any differently. Additionally, neither citation appears to discuss a continuous interface.

Because the Selvakumar and the Nakagawa reference each taken alone do not show every element of Applicant's independent claims, a 35 USC § 102(b) rejection is not supported. Further, applicant submits that for the reasons stated above, an alternative 35 USC § 103(a) rejection is not supported by the cited single references when presumably combined with general knowledge. Reconsideration and withdrawal of the rejections is respectfully requested with respect to Applicant's independent claims 11, 24, 25, 28, 38, 40, and 41. Additionally, reconsideration and withdrawal of the rejection is respectfully requested with respect to the remaining claims that depend therefrom as depending on allowable base claims.

CONCLUSION

Applicant respectfully submits that the claims are in condition for allowance and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's attorney at (612) 373-6944 to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

LEONARD FORBES

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Date 5-28-02 By ______

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CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to: Commissioner of Patents, Washington, D.C. 20231, on this 28th day of May, 2002.

Name Amy Moriarty Signature ______